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Some Dragon Flies of Southeastern Kansas.*

VERNON C. ALLISON.

The dragon flies described in this paper were all caught within a radius of two and one-half miles of the Kansas State Manual Training Normal campus. The localities visited were Playter's lake; the strip pits just west of the Fairview dairy barn; Cow creek and the pasture this side on west Quincy; the strip pits west of Cow creek on the north side of Quincy, and on Cow creek near the Missouri Pacific bridge. A few were caught near the Missouri Pacific bridge over Second Cow creek.

Thirty-four species were collected and classified during the years 1913, 1914 and 1915, and the list of dragon flies in this neighborhood is not yet complete.

They begin to appear in this section about the first of May, in the following order: *Plathemis lydia*, *Libellula basalis*, *Ceothemis elisa* (the males quite awhile before the females), *Tramea lacerata*, *Pantala hymeneæ*, *Pantala flavescens*, *Tramea onusta*, *Anax junius*, *Pachydiplax longipennis*, etc. The Agrionidæ and *Dromogomphus spoliatus* become common about the middle of July, the *Æschinæ* in August and the *Pantala* in late August and early September. The *Sympetrum* does not appear until late August and are present in great numbers during the month of September.

The early dragon flies decrease about the middle of July, but a second crop appears the latter part of the month. A great number of teneral may be observed at this time. The latter part of August witnesses the final decrease of the early dragon flies—Libellulidæ, etc.

With the exception of the *Tramea*, rain drives the dragon flies to shelter. They seek shelter according to the following order: *Libellula basalis*, *Plathemis lydia*, *Pachydiplax longipennis*, *Perithemis domitia*, *Epicordula princeps*, *Libellula auripennis*, *Mesothemis simplicollis*, *Anax junius*. The *Trameas* seem actually to increase their activity during a rainstorm of twenty minutes or less. On misty days the *Pantala* gather in large numbers in small clearings between the trees. A rain the night before or a heavy dew delays the morning appearance of the dragon flies for several hours.

Wind forces most of the dragon flies (the Agrionidæ especially) to the shelter of the grass, weeds and trees. A very few *Libellula basalis*, *Plathemis lydia*, *Perithemis domitia*, *Pachydiplax longipennis* and *Libellula auripennis* brave the wind. The *Tramea* and *Pantala* fly much higher on slightly windy days.

The heated part of the day compels most of them to the shade, although a few listless ones stay out in the sun.

The *Plathemis lydia*, *Libellula basalis*, *Libellula pulchella* and *Pachydiplax longipennis* fly from 8:30 a. m. to dark, while the others fly from 8:30 or 9:00 a. m. to 11 a. m. and from about 4 p. m. till dark.

The *Æschna pentacantha* will make short flights of about fifteen or twenty minutes' duration out over the fields, returning at the end of the period to a favored spot (the same spot each time), generally a shaded birch leaf overhanging the water. They appear to go to "roost" about 5:30 p. m.

* "The Insect Book," Howard; Hagen's "Neuroptera"; "The Dragon Flies of Indiana," by E. B. Williamson, were used in this work.

The *Dromogomphus spoliatus* patrol the bank until about 4 p. m., when they become more and more active, flying higher and farther away from the water.

Great swarms of *Anax junius* sometimes invade town about 7:30 p. m., flying very low to catch the evening-flying diptera. Such a swarm (about 1,000) was observed at the corner of Walnut and Euclid.

In the morning the dragon flies appear in the following order: *Epicordula princeps*, *Libellula auripennis*, *Libellula pulchella*, *Libellula basalis*, *Tramea onusta*, *Tramea lacerata*, *Perithemis domitia*, *Celethemis elisa*, *Pachydiplax longipennis*, *Mesothemis simplicicollis*, and, lastly, *Anax junius*.

The *Tramea* and *Pantala* are extremely hard to catch. They fly high, and the only way to catch them is to stand patiently out in the sun in a conspicuous place, and when their curiosity (common to all dragon flies) lures them down, catch them with a thirty-inch net on an eight-foot pole. Coupled dragon flies, especially the *Agrionodæ*, are much more wary than the single ones.

Williamson (page 236) says: "Red mites (*Acarina*) are frequently found on the under surface of the thorax or abdomen." He is speaking of dragon flies in general. I have very rarely observed them except on the *Pachydiplax longipennis* and the *Tramea*. They are very common on the *Tramea lacerata* and *Tramea onusta*, accompanied by small black mites the same size.

The wings of the female *Tramea onusta* are for some reason nearly always badly frayed. *Plathemis lydia* are sometimes found with the venation of the front wing pied around the triangle.

The *Tramea* have a peculiar habit of parading during copulation. From two to six coupled pairs will parade for hours, maintaining a fixed equal distance between each couple. Once in a while a pair will alight on a leaf high up from the ground and remain several minutes.

The low-flying *Libellulidæ* are frequently captured by flickers. I have, however, seen swallows and martins repeatedly fail to get the high-flying *Tramea* and *Epicordula princeps*. The *Tramea* or *Epicordula princeps* would wait until the bird was very close and shoot up with extreme rapidity, about two feet, and allow the oncoming swallow or martin to pass beneath them. The dragon fly would then calmly await another attack.

Fishermen claim that the female *Libellulidæ* are often caught, while ovipositing, by bass. I have seen the bass attempt it several times but fail each time.

Dragon flies, even *Anax junius*, with their powerful side-cutting mouth parts, can make no impression on the tough body of the large wasps. The *Agrionidæ* are sometimes caught in spider webs. The male *Mesothemis simplicicollis* is in the habit of attacking and eating the *Perithemis domitia*.

The male *Ischnura verticalis* does not seem to use (or have) hooks on the superior end of his abdomen to seize the superior organs of the female during copulation, as other species do. He uses the tibiæ of his hind legs instead.

All authors on dragon flies remark upon the exceptional voracity of the dragon flies. Every dragon fly will eat any other dragon fly or insect that it can overcome. Williamson tells of a large dragon fly that was chloroformed and pinned down through the thorax. On coming to it started to struggle, but remained quiet as long as it was fed. A large dragon fly ate forty mosquitoes

in an hour. I have held a dragon fly by the wings and presented the outer end of its abdomen to its mouth. It ate the outer three segments of its own abdomen without a struggle. Any one or all four wings may be removed, even down to a distance of 1 mm. from its body, and the dragon fly makes no struggle as long as it is fed. It may be that they do not feel pain or that they are unable to localize pain.

Some dragon flies, especially some of the Libellulidæ, seem to parole a regular beat on a regular schedule, inspecting everything in their path. All dragon flies, with the exception of *Perithemis domitia*, are very curious. They are the fastest flying of all known forms of life, and also maneuver very quickly. They catch their prey on the wing, seizing it with their front legs and eating it while in the air.

The almost filled-up strip pit on the north side of Quincy, about 200 yards west of the Fairview dairy barn, seems to be monopolized by the *Libellula pulchella*.

The thirty-four species classified follow:

1. *Æschna pentacantha*. Rare. Around water in shade. West Quincy.
2. *Æschna verticalis*. Not rare. West of Cow creek, on Quincy.
3. *Anomalagrion hastatum*. Not common. Playter's lake.
4. *Anax junius*. Common. Water, pastures, etc.
5. *Argia apicalis*. Common. Low-growing water plants.
6. *Argia putridia*. Common. Low-growing water plants.
7. *Argia violacea*. Common. Low-growing water plants.
8. *Celethemis elisa*. Common. Water, roads, pastures, etc.
9. *Celethemis eponina*. Very rare. Smith's pasture, West Quincy.
10. *Dromogomphus spoliatus*. Common. Weeds along still water, Playter's.
11. *Enallagma aspersum*. Common. Low-growing water plants.
12. *Enallagma civile*. Common. Low-growing water plants.
13. *Enallagma signatum*. Common. Low-growing water plants.
14. *Epicordula princeps*. Common. Pastures, still water.
15. *Ischnura verticalis*. Common. Low water plants.
16. *Lestes unguiculatus*. Not common. Still water.
17. *Libellula auripennis*. Fairly common. Still water.
18. *Libellula basalis*. Very common. Roads, pastures, lakes.
19. *Libellula cyanea*. Not common. Still water.
20. *Libellula pulchella*. Common. Water.
21. *Libellula vibrans*. Not common. Still water.
22. *Macromia tæniolata*. Not common. Running water.
23. *Mesothemis simplicicollis*. Common. Water.
24. *Pachydiplax longipennis*. Common. Water, birch trees.
25. *Pantala hymenæa*. Common. Pastures, still water.
26. *Pantala flavescens*. Common. Pastures, still water.
27. *Perithemis domitia*. Common. Low water plants.
28. *Plathemis tydia*. Very common every place.
29. *Sympetrum albifrons*. Fairly common. Pastures.
30. *Sympetrum corruptum*. Fairly common. Pastures.
31. *Sympetrum vicinum*. Fairly common. Pastures.
32. *Sympetrum semicinctum*. Fairly common. Pastures.
33. *Tramea lacerata*. Fairly common. Pastures, water.
34. *Tramea onusta*. Fairly common. Pastures, water.

ORDER ODONATA.

SUBORDER ANISOPTERA. Wings horizontally extended when at rest.

SUBORDER ZYGOPTERA. Wings folded when at rest.

SUBORDER ANISOPTERA.

FAMILY ÆSCHNIDÆ. Cross veins between first and second longitudinal veins do not correspond to the cross veins between the second and third longitudinal veins. Triangle of the front wing generally of the same shape as the triangle of the hind wing.

Subfamily CORDULEGASTERINÆ. Eyes meet at a single point on top of the head, or barely separated.

Subfamily GOMPHINÆ. Eyes separated at least the width of the apical wing spot—generally more.

Subfamily ÆSCHINÆ. Eyes meet on top of head for some distance.

FAMILY LIBELLULIDÆ. Cross veins between the first and second longitudinal veins generally correspond to the cross veins between the second and third longitudinal veins (exception of the first cross vein and one other). The long axis of the front wing triangle (vertical) is at right angles to the long axis of the hind wing (horizontal).

Subfamily CORDULINÆ. Small tubercles behind the eyes. Anal margin of the hind wings is excavated.

Subfamily LIBELLULINÆ. Eyes without tubercles. Anal margin of the hind wings not excavated.

SUBORDER ZYGOPTERA.

FAMILY AGRIONIDÆ.

Subfamily CALOPTERYGINÆ. More than two cross veins between the first and second longitudinal veins between the base of the wing and the nodus (the nodus is the meeting place of the longitudinal veins between the tip of the wing and the base).

Subfamily AGRIONINÆ. Only two cross veins between the first and second longitudinal veins between the base of the wing and the nodus.

COLOR KEY.

Following is a color key which may be of some service in classifying these dragon flies:

SUBORDER ANISOPTERA. Wings horizontally extended when at rest.

BLACK OR DARK BROWN.

Medium size. Basal one-third wings black. Female, apices wings tinged brown.
Libellula basalis.

Medium to large. Three large black spots on wing. Female, *triangle in front wings colored to some extent*.....*Libellula pulchella.*

Medium. Small inner and large outer spot, black. Female similar to female *L. pulchella*, but smaller. *Triangle in front wings entirely uncolored*.....*Plathemis lydia.*

Medium to large. Ragged black spot at base of wing.....*Tramea lacerata.*

Large. Similar to *L. pulchella*. Throat large, giving body club-shaped appearance.
Epicordula princeps.

Medium to large. Small chocolate brown spot at base, at nodus, and at tip of wings. Apical spots bicolored.....*Libellula cyanea.*

BLACK AND WHITE.

Medium to large. Old males of the following species have the abdomen and those parts of the wings not black, chalky white.....*Libellula basalis.*
Libellula pulchella.

Medium. Old males have abdomen (but not wings) chalky white.....*Plathemis lydia.*

BLUE AND GREEN.

Small. Greenish face. Old males gray-blue, chalky.....*Pachydiplax longipennis.*

Very large. Male, green and blue. Female, green and purplish brown.....*Anax junius.*

Medium. Male, green and black or (old) chalky. Female, green and dark brown.
Mesothemis simplicollis.

Very large. Bronze green and yellow. Large yellow band encircling thorax between front and hind wings.....*Marcromia taniolata.*

Medium to large. Old male blue, chalky. Apical spots bicolored....*Libellula cyanea.*

RED, REDDISH-BROWN AND YELLOW.

- Medium. Reddish brown. Brown spot at base of hind wings.....*Pantala hymenæa*.
 Medium. Yellowish. Yellow tinge at base of hind wings.....*Pantala flavescens*.
 Small. Yellow or red, marked with black. Apical spots red.....*Celetehemis elisa*.
 Very small. Male, yellowish brown. Wings entirely colored reddish yellow.—First female.
 Yellowish brown. Wings colored like male.—Second female.
 Yellowish brown. Wings clear with brown spots.....*Perithemis domitia*.
 Medium. Reddish brown. Reddish brown basal area on hind wing....*Tramea onusta*.
 Large. Yellowish or reddish brown. Wings entirely tinged with yellow or reddish.
 Libellula auripennis.
 Large. Greenish yellow marked with brown. End of abdomen much enlarged and yellow.
 Dromogomphus spoliatus.
 Small. Reddish yellow spotted with black. Light forehead.....*Sympetrum albifrons*.
 Small. Yellow to red. Wings yellowish at base.....*Sympetrum vicinum*.
 Small. Yellow to red. Wings yellowish from base to nodus....*Sympetrum semicinctum*.
 Medium. Yellow to red. Veins of wings yellowish red or brown..*Sympetrum corruptum*.
 Very large. Reddish brown marked with bright green.....*Æschna pentacantha*.
 Large. Reddish brown marked with green and blue.....*Æschna verticalis*.
 Small to medium. Yellow or red marked with black. Blotches on the wings.
 Celetehemis eponina.
 Medium to large. Yellow and chocolate brown. Apical spots bicolored..*Libellula syanea*.
 Large. Yellow and reddish brown. Apical spots bicolored.....*Libellula vibrans*.

SUBORDER ZYGOPTERA. Wings folded when at rest (*Lestes*, wings half-folded when at rest).

BLUE.

- Medium. Mature female, head and thorax pale blue.....*Argia putrida*.
 Small. Male, blue. Female, lighter blue.....*Enallagma aspersum*.
 Small to medium. Male, blue and black. Female, duller—sometimes yellowish green.
 Enallagma civile.
 Medium. Male, pale blue or drab. Female (adult), pale blue and (young), light brown.
 Argia apicalis.

VIOLET.

- Small to medium. Male, violet. Female, dull violet or brown.....*Argia violacea*.

GRAY OR DRAB.

- Medium. Male, grayish drab or dull light brown.....*Argia putrida*.

BROWN.

- Medium. Young females, light brown.....*Argia putrida*.
 Medium. Young females, light brown.....*Argia apicalis*.
 Medium. Male, blackish brown; under parts, yellow. Young females similar. Old females, markings obscured*Lestes unguiculatus*.

YELLOW AND ORANGE.

- Small. One female, orange and bronze black.....*Ischnura verticalis*.
 Medium. Male, orange. Female, similar with some bluish.....*Enallagma signatum*.
 Small. Apical spot displaced. Male, orange and black. One female similar to male; another with much black, including top of abdomen.....*Anomalagrion hastatum*.

GREEN.

- Male, green. One female green.....*Ischnura verticalis*.

DETAILED DESCRIPTION.

ANISOPTERA. Wings horizontally extended when at rest.

1. *Æschna pentacantha* Rambur (probably *aischros*, Gr., ugly; *pente*, Gr., five; *acantha*, Gr., a thorn). Both sexes, abdomen, 56 mm.; hind wing, 48 mm.

Male and female reddish brown, marked with bright green; face green or brown. Thorax with broad green stripe on either side above, short, green stripe in front of shoulder, and two green or blue stripes on either side. Abdomen marked with green and blue spots and rings, constricted at segment 3. No T-spot on top of forehead.

Habits: From August to late in the fall they frequent the edges of woods close to pools or small streams. They rest on leaves and twigs in the middle of the day, becoming more active later in the day, flying out over the fields, returning about once in thirty minutes to some particular shady spot near the water. As darkness comes on, the resting periods become longer and longer until they cease flying altogether.

2. *Æschna verticalis* Hagen (*vertex*, Lat., highest point). Abdomen: male, 52 mm.; female, 53 mm. Hind wing: male, 45 mm.; female, 46 mm.

Male and female reddish brown, marked with green and blue. Thorax with a green stripe on either side above, wider towards the top; sometimes a short green stripe in front of the shoulder and two green or blue stripes on either side, the forward one most distinct. Abdomen with spots and rings of green and blue. Abdomen is more slender than in *Æschna constricta*, constricted at segment 3.

Habits: Somewhat similar to above. From August on.

3. *Anax junius* Drury (*anax*, Gr., a king; *junius*, a Latin proper name). Abdomen: male, 55 mm.; female, 54 mm. Hind wing: male, 51 mm.; female, 52 mm.

Male: Green marked with blue and brown; face green; forehead above with a dark spot, surrounded by yellow, the latter surrounded by a blue ring. Thorax green. Abdomen with segment 1 and base of segment 2 green; segments 3 to 19 bright blue with a longitudinal interrupted brown band on top. Wings tinged with yellowish. Abdomen constricted at segment 3.

Female similar. Abdomen with blue of male replaced by purplish brown.

Habits: Piratical. Large flocks fly low at dusk to catch the low-flying diptera. Becomes common in June. About this time they are found pairing and ovipositing about every weedy pond. Williamson says (page 306): "They fly about in couples, then drop down on some bit of floating stuff, where they rest a moment or so, the female with her abdomen submerged as she deposits her eggs; then the pair rise and fly back and forth along the shores or over the water, coming to rest again near or at a distance from their former resting place." May on.

4. *Celethemis elisa* Hagen (proper name). Abdomen: male, 21 mm. female, 19 mm. Hind wing: male, 26 mm.; female, 25 mm.

Male and female: Yellow or red, marked with deep brown or black. Thorax with a shoulder, two side and a middle-of-the-back stripe, more or less black. Abdomen black, with the backs of segments 3 to 7 and the sides of segments 1 to 6 red or yellow. Front wings with the top row of cross veins and some other cross veins edged with brown; a small spot above the triangle (often lacking) brown, rounded spot near the top longitudinal vein between the nodus and apical spot and the tip of the wing from the apical spot on, brown (female, extreme tip of wing colorless and clear). Hind wings similar; a large brown basal area extending beyond the triangle and running backward almost to the rear basal margin; this brown incloses a paler tawny area.

Habits: Females retiring; outer edge of plants which border streams. Males are found out in the open pastures, each perched on a low shrub 3 or 4 feet from the ground, sometimes on flowers or sumach, which harmonize with their coloring. Each individual is master of his particular preserve, and may be frequently seen to sally forth and seize a passing fly. Very quarrelsome among themselves, they are "the butt of Odonate society, for *Anax*, *Libellula* and *Celethemis eponina* are sure to pay it their disrespects whenever they spy it in passing." July to October.

5. *Celethemis eponina* Drury (*epona*, Lat., goddess of horses). Abdomen: male, 26 mm.; female, 24 mm. Hind wing: male, 33 mm.; female, 32 mm.

Male and female: Reddish brown and yellow. Thorax with a middle-of-the-back stripe and two side stripes, blackish. Abdomen black with yellow spots. Brownish spots on front wings as follows: a spot covering much of the triangle and lying above and between it and the body, a nodal band running from the front edge of the wing almost to the back edge, and a band of

similar width and length just inside the apical spot. Hind wings similarly marked: a spot extending from the base to and covering the triangle, a rounded spot behind this, a nodal band constricted at the middle, sometimes divided to form two spots. Extent of markings subject to considerable variation.

Habits: I captured only one specimen (the only one I saw). I caught a male on August 15, 1913, in Smith's pasture.

6. *Dromogomphus spoliatus* Hagen (*dromos*, Gr., flight; *gomphos*, Gr., wedged-shaped bolt; *spoliatus*, Lat., impoverished). Abdomen: male, 41 mm.; female, 43 mm. Hind wing: male, 34 mm.; female, 36 mm.

Male and female: Yellow or greenish yellow, marked with brown; face greenish. Thorax brown above. The following is yellow: a mid-cross stripe on top of the thorax, a collar on top, an oblique bar on either side, a narrow stripe (sometimes interrupted) in front of the shoulder. Sides of the thorax are generally a greenish yellow, with a brown stripe on each suture. The abdomen has segments 1 to 6 black or dark brown above, with irregular interrupted longitudinal stripes down the back and on each side yellow. Segments 7 to 9 are greatly dilated, yellow, clouded and shaded with brown; segment 10 is entirely yellow. Apical spot light brown. Front rib of the wing greenish. The abdominal appendages are entirely yellow.

Habits: Common over still water. Fly slowly but warily over the water, close to the shore, copulating and ovipositing until about 4 p.m., when they leave the vicinity of the water and fly out over the fields at a height of 20 to 30 feet. Common from July on.

7. *Epicordula princeps* Hagen (*epi*, Gr., near to; *cordyle*, Gr., a club; *princeps*, Lat., a chief). Abdomen: male, 43 mm.; female, 46 mm. Hind wing: male, 41 mm.; female, 44 mm.

Male: Olive or yellowish brown, obscurely marked with yellow. Thorax clothed with a very fine fuzz; markings obscured. Abdomen with yellow along the sides. Wings with a basal, a nodal (this is sometimes wanting) and an apical spot, all variable in size, brown. The superior appendages (the superior appendages are those at the outer end of the abdomen) are almost as long as segments 9 and 10 and the outer two-thirds are expanded; the inferior appendages are less than one-third shorter, long, triangular; apex with two upturned points.

Female similar. Appendages are as long as segments 9 and 10. The vulvar lamina are almost as long as 9, divided for their entire length and forked at the end.

Habits: Fairly common over still water. Strong and restless flyers. Easily distinguished from *Libellula pulchella*, which they resemble in wing markings, by the large size of their thorax in comparison with their abdomen, giving them a club-shaped appearance. June on.

8. *Libellula auripennis* Burmeister (*aureus*, Lat., golden; *penna*, Lat., a wing). Abdomen: male, 38 mm.; female, 36 mm. Hind wing: male, 40 mm.; female, 39 mm.

Male and female: Yellow or reddish brown. Young individuals with a yellow mid-stripe down the back of the thorax. Abdomen with a black mid-stripe on top. Wings yellowish or reddish ("golden"), especially along the front margin; tips of the wings sometimes brown.

Habits: Rather wary. Fairly common about still water. July to October.

9. *Libellula basalis* Say (*basis*, Gr., base). Abdomen: male, 31 mm.; female, 27 mm. Hind wing: male, 40 mm.; female, 39 mm.

Male: Blackish brown. Abdomen yellow on both sides; this is obscure in older individuals. The basal one-third of the wings are dark brown or black, in older individuals chalky white. The basal black area on the front wings is darkest beyond the base.

Female: Wings with less black, sometimes only a dark tinge extending to the triangle, on the front wings no chalky white beyond the dark area; tips usually dark.

Habits: Very curious; stick their noses into everything; patrol a regular beat; easy to catch, frequently lighting on the net. Very common from May to October, the first brood appearing in May and the second about the latter part of July.

10. *Libellula cyanea* Fabricius (*libella*, Lat., a water level; *cyaneos*, Gr., dark blue). Abdomen: male, 29 mm.; female, 27 mm. Hind wing: male, 35 mm.; female, 34 mm.

Male and female: Chocolate brown and dull yellowish. A brown mid-stripe on top of the abdomen. Thorax with yellow sides and a yellow mid-stripe on top. Basal streak in the front wings between the second and third longitudinal veins and a shorter one usually between the fourth and fifth longitudinal veins. Sometimes the tips of the wings are brown. The bicolored apical spot is yellowish at either end. The older males become entirely chalky white and much resemble the older males of *Mesothemis simplicicollis* except for the bicolored apical spot.

Habits: Around still water. Not common. June on.

11. *Libellula pulchella* Drury (*pulchellus*, Lat., beautiful). Abdomen: male, 34 mm.; female, 32 mm. Hind wing: male and female, 42 mm.

Male and female: Blackish brown. Sides of thorax with two wide yellowish stripes. Abdomen with yellow stripe on each side; chalky white in the older males. Wing spots black or dark brown; a basal spot between the first and second or the second and third longitudinal veins, extending to or beyond the triangle, covering the triangle completely in the hind wings, more or less in the front wings; a large nodal and a large spot at the tip of the wings. Male usually with the back portion of the hind wing and spots alternating with the black spots on all the wings, chalky white.

Habits: Swift fliers. Common about water. Sometimes a single specimen keeps a hunting preserve, driving off all others except *Anax junius*. July to October.

12. *Libellula vibrans* Fabricius (*vibrans*, Lat., fluttering). Abdomen: male, 40 mm.; female, 38 mm. Hind wing: male, 48 mm.; female, 47 mm.

Male and female: Yellow and reddish brown. Yellow mid-stripe on top of thorax, and sides of the thorax yellow with slight blackish markings. The sides of the abdomen are yellow. The older males are chalky white, obscuring the markings. Wings: There is a long black basal streak between the second and third longitudinal veins; tip of the wing black (especially in the female), and a black spot at the nodus.

Habits: Not common. August on.

13. *Macromia tæniolata* Rambur (*tæniola*, Lat., a little band). Abdomen: male, 60 mm.; female, 62 mm. Hind wing: male, 54 mm.; female, 58 mm.

Male: Brown and metallic green, marked with yellow; face brown. Crosswise yellow nose band. Thorax with a short yellow cross stripe on top and a broad yellow band entirely encircling the thorax between the front and the hind wings. Abdomen with an interrupted crosswise ring on segment 2, a divided spot on the tops of segments 2 to 8 (larger and usually united on 7), yellow. Wings tinged with yellowish.

Female similar, often lacking the yellow spot on segment 8. Wings more yellowish.

Habits: Rather uncommon. Running water. July to October.

14. *Mesothemis simplicicollis* Say (*mesos*, Gr., middle; *themis*, Gr., the goddess of justice; *simplex*, Lat., simple; *collum*, Lat., neck). Abdomen: male, 30 mm.; female, 29 mm. Hind wing: both, 31 mm.

Male: Green and black; face green. Thorax green, sometimes sutures black. Abdomen mostly green basally, outer half mostly black. In older males the thorax and abdomen become entirely a chalky, grayish blue. Superior appendages whitish, toothed underneath.

Female: Green and dark brown, similar to the young male. Vulvar lamina are elevated, triangular, entire.

Habits: Female generally hidden in the weeds about water, feeding. Male is very active. Williamson observed the male to eat butterflies (*pamphila*), moths and dragon flies (*Lestes vigilax* and *Argia violacea*). Several times I have seen a male seize and decapitate a *Perithemis domitia*. Because of his very rapid movements and radical change in coloring, (changing from green and black to a light grayish blue as he grows older), the old males are easily mistaken for members of entirely different species. June on.

15. *Pachydiplax longipennis* Burmeister (*longus*, Lat., long; *penna*, Lat., wing). Abdomen: male, 24 mm.; female, 22 mm. Hind wing: male, 29 mm.; female, 28 mm.

Male: Young, face whitish or greenish, forehead and top of head metallic blue. Thorax dark brown, with several yellowish or greenish markings, including three broad stripes on sides. Abdomen black or brown with interrupted greenish stripes on top and sides. In older males the thorax and abdomen become chalky, and the markings thus obscured. Wings clear, sometimes tinged with brown, especially between the nodus and the apical spot; dull yellow at the base; hind wings sometimes with a short black streak lengthwise of the wing.

Female: Similar to young male; occasionally chalky in old individuals.

Habits: Very common on water plants; apparently preferring birch trees as a resting place. Sometimes carries parasites like those on the *Tramea* (Acarina). Males sometimes seen at a little distance from the water.

16. *Pantala hymenæa* Say (*hymenæus*, Lat., god of marriage). Abdomen: male, 30 mm.; female, 31 mm. Hind wing: male, 41 mm.; female, 42 mm.

Male and female: Reddish brown, marked with darker brown. Abdomen banded and ringed. Hind wing with the anal angle yellowish and with a round, dark, yellowish-brown spot; tips of the wings sometimes tinged with yellow.

Habits: Fly during July and August, and are very difficult to capture. They move swiftly, sometimes at a considerable height (40 to 100 feet), apparently never alighting. I have succeeded in obtaining specimens only by standing for an hour or so in a conspicuous place, when they are apparently lured by curiosity within reach of a long net. July on. This species is confined to North America.

17. *Pantala flavescens* Fabricius (*pan*, Gr., all; *ala*, Lat., wing; *flavescens*, Lat., turning light yellow). Abdomen: male, 32 mm.; female, 33 mm. Hind wing: male, 41 mm.; female, 40 mm.

Male and female: Yellowish. Abdomen with a whitish mid-stripe on top, absent from some segments; sides of segments 1 to 8 are black. The anal margin of the hind wings is yellowish; tips of the wings are sometimes tinged with yellow. It is a cosmopolitan species.

Habits: Same as *hymenæa*. These two species comprise the genus. July on.

18. *Perithemis domitia* Drury (Latin proper name). Abdomen: male, 14 mm.; female, 13 mm. Hind wing: male, 18 mm.; female, 19 mm.

Male: Yellowish brown. Markings obscure. Thorax sometimes with two pale side stripes. Abdomen with some yellow marks. Wings a uniform tawny yellow, or sometimes with a brown spot near the triangle and a basal brown streak on the hind wings.

Female: Wings clear; front wings tinged yellowish along the first longitudinal vein, a yellowish-brown spot or area bordered with yellow near the triangle and another and larger one at the nodus; hind wings similar, the inner colored area covering the triangle and extending backward toward the anal angle. These markings vary greatly. Males are sometimes found with the wings colored very much as in the female. I find a very common dimorphic female, in which the wings are clear, colorless and spotted with brown; the body coloring is the same as in the other female. (This form is illustrated in Howard's "Insect Book," but is not referred to by Williamson.)

Habits: Very timid and retiring, perching on low water plants. They are very much annoyed by the *Libellula* and by *Anax junius*. June on. The spotted-winged female appears about the middle of July.

19. *Plathemis lydia* Drury (a proper name). Abdomen: male, 28 mm.; female, 24 mm.; hind wing: both 33 mm.

Male and female: Brown. There are two yellow stripes on each side of the thorax. The older males have the thorax largely and the abdomen entirely chalky. The males have the wings marked as follows: a basal spot between the first or second and the fifth longitudinal veins, extending to the triangle in the front wings and to and covering the triangle in the hind wings; the basilar space is almost clear; a wide band for the entire width of the wing between the nodus and the apical spot. The above markings are dark brown or black. There is a chalky-white spot behind each basal spot, sometimes wanting in the front wings.

Female: Wing markings are much like *Libellula pulchella*, but the triangle of the front wing is entirely clear and untinged. The abdomen is heavier than that of the female *Libellula pulchella*.

Habits: Extremely curious and fearless. With *Libellula basalis*, they are the buttinskys of the Odonata. Very common. Female retiring except when copulating or ovipositing. Male suns himself except when patrolling or copulating. April to October. Our earliest and hardest dragon fly. I have been told by fishermen that the large-mouth black bass often catches the ovipositing female, and have myself seen several attempts which were, however, unsuccessful.

20. *Sympetrum albifrons* Charpentier (*sympiedge*, Gr., to press together; *etn*, Gr., the abdomen; *albus*, Lat., white; *frons*, Lat., front). Abdomen: both 24 mm. Hind wing: both 25 mm.

Male and female: Reddish yellow. Abdomen red (adult) or yellow (young), spotted with black. The wings are yellow at the extreme base. The vulvar lamina are short, rounded and the apex is notched. This and following species of *Sympetrum* are similar in coloring and can best be identified by the intromittent genital organs of the male, which differ markedly in the different species.

Habits: Common August to November. Still water, swampy ground and meadows.

21. *Sympetrum corruptum* Hagen (*corruptus*, Lat., marred or spoiled). Abdomen: male, 27 mm.; female, 28 mm. Hind wing, male, 29 mm.; female 30 mm.

Male and female vary greatly in coloration at different stages.

Young: Thorax yellowish. Following markings grayish: narrow shoulder stripe, stripe in front of the shoulder, and two side stripes terminated below by a bright yellow spot (later all these markings disappear except the two yellow side spots). The abdomen is yellowish; some black on the sides and above on segments 8 and 9.

The fully adult *corruptum* is red. Veins and apical spot yellowish and brown, or red. The legs are black, sharply lined with yellow.

Habits: Similar to above. August to November.

22. *Sympetrum semicinctum* Say (*semi*, Lat., half; *cinctus*, Lat., encircled). Abdomen: both 20 mm. Hind wing: both 23 mm.

Male and female: Coloration as in the other species, yellow to red, sides of the abdomen spotted with black. The front wings are yellowish brown from the base to the nodus or triangle. The hind wings are also yellowish brown from the base to the nodus, but are usually lighter at the base.

Habits and occurrence same as the above.

23. *Sympetrum vicinum* Hagen (*vicinus*, Lat., neighborly). Abdomen: male, 21 mm.; female, 22 mm. Hind wing: male, 24 mm.; female, 23 mm.

Male and female: Yellow to red (female sometimes brown). Black side markings on the abdomen. The wings are yellow at base only. The yellow on the wings is usually distinct.

Habits similar to the preceding. August, well into November.

24. *Tramea lacerata* Hagen (*trama*, Lat., spider's web; *lacertus*, Lat., torn). Abdomen: male, 36 mm.; female, 35 mm. Hind wing: male, 43 mm.; female, 44 mm.

Male and female: Brownish black. Top of abdomen with white or greenish spots, segment 7 usually conspicuously light colored, especially in the female. Front wings with a little brown at the base; hind wings with a large ragged black spot at the base; in teneral (young, shiny, winged specimens) this is reddish or yellowish brown. The male superior abdominal appendages are as long as segments 8, 9 and 10. The vulvar lamina of the female are as long as segment 9 and bilobed.

Habits: In the morning, fairly common about water; in the afternoon and evening are found at some distance from water, flying high over dry pastures. Small red or black parasites (Acarina) are often found on the under side of the thorax and on the under side of the base of the front wings, as in *Pachydiplax longipennis*. Middle of June on.

25. *Tramea onusta* Hagen (*onusta*, Lat., burdened). Abdomen: male, 31 mm.; female, 33 mm. Hind wing: male, 40 mm.; female, 42 mm.

Male and female: Reddish brown. Front wing tinged at base. Hind wing with a reddish-brown basal area, not so ragged as in the *lacerata*. Male superior abdominal appendages are a little longer than segments 9 and 10. The vulvar lamina of the female are as long as segment 9, and bilobed.

Habits: Very similar to the *lacerata*. Has a habit of parading during copulation. From two to six couples will parade a regular beat in single file, preserving a relatively fixed distance between each other. I have never observed this promenade in any other species. Sometimes a coupled pair on a leaf of a tree (high up from the ground), remain for several minutes. I have watched swallows and martins unsuccessfully attempting to capture some of the high-flying *Tramea lacerata* and *onusta* and *Epicordula princeps*. The dragon flies await the rush of the swallow until the bird approaches within a few feet, then arise with extreme rapidity a distance of about two feet and allow the bird to pass beneath them. The dragon flies really seemed to enjoy the exercise. On the other hand, I have seen *Libellula* caught with ease by flickers. Common from July on.

Out of a dozen or more species I have only one whose rear wing is not badly damaged (I am speaking of the female only). I am at a loss to explain this except on the grounds of the honeymoon parade.

ZYGOPTERA. Wings folded when at rest (*Lestes*, half folded).

1. *Anomalagrion hastatum* Say (*anomales*, Gr., irregular; *agrion*, Gr., wild animal; *hastatum*, Lat., armed with a spear). Abdomen: male, 18 mm.; female, 19 mm. Hind wing: male, 11 mm.; female, 13 mm.

Male: Orange or yellow. Vertex black. Spots behind the eyes are small and not connected. Wide mid-stripe on the top of the thorax; shoulder stripes and spot above on the second suture, bronze-black. Abdomen yellow or orange with bronze-black, as follows: all of segments 1 and 2, much of 3 (basal and outer spots on 3, usually meeting on the mid-line), basal and outer spots (variable in size) on 4 and 6, and on 7 basally. Apical spot on front wing removed from the first row, oval, reddish; on the hind wing normal in position, black. The back end of the top side of segment 10 bears a slender two-pronged spine. Superior abdominal appendages are half as long as segment 10, two-pronged; inferiors a little longer than the superiors. Legs pale, lined with dark.

Black female: Similar to male. Top of abdomen black; pale, interrupted basal rings on segments 3 to 6. Apical spot displaced; brown alike on all wings.

Orange female: Similar to male; spots back of the eyes are continuous with the orange on the back of the head. Shoulder stripe on thorax reduced or wanting. Abdomen with a spot on the middle of the top of segment 1, at base of 2; outer rings on 2 to 4, and all of 5 or 6 to 8 or 9, bronze-black.

Habits: Not common. June on. Marshes and swamps bordering streams or still water.

2. *Argia apicalis* Say (*apex*, Lat, extreme end). Abdomen: male, 29 mm.; female, 31 mm. Hind wing: male, 21 mm.; female, 23 mm.

Male: Pale blue or drab. Vertex, mid-stripe on top of thorax, and a spot on the shoulder suture above and below, black. Abdomen dark brown or black, segments 3 to 7 with pale, narrow basal rings; last two segments blue.

Female: Young are light brown; adult blue, like male. Shoulder stripes small or wanting. Abdomen dark; top black with the outer half of segment 9

and all of 10, yellow. Adults are distinguished from *putrida* by the brighter and clearer color of the thorax.

Habits: Like *putrida*. June on.

3. *Argia putrida* Rambur (*argia*, Gr., idleness; *putridus*, Lat., polluted). Abdomen: male, 34 mm.; female, 32 mm. Hind wing: male, 24 mm.; female, 25 mm.

Male: Gray or light brown. Vertex, mid-stripe on top of thorax and a stripe on either side, black. Abdomen black; first segment sometimes pale above; 3 to 7 with pale, narrow basal rings. Older males chalky. Wings with the upper sector of the triangle ending on the margin far out and almost on a level with the apical spot. Legs pale, lined with dark. Apex of segment 10 cut out, sides produced. Appendages short.

Female: Younger specimens brown, much like male, with abdomen mostly brown. Mature females have the head and thorax pale blue, with black mid-markings on the top of the thorax and very narrow black lines on the sutures. Abdomen brown above, bounded on either side with an interrupted black stripe; below the black, pale blue or greenish.

Habits: Common from July on, about both still and running water. In contradistinction to the *Lestes*, *Enallagmas* and other smaller Agrionines, it prefers the glaring sun of the rocky or bare banks to the rank grasses and weeds.

4. *Argia violacea* Hagen (*violaceus*, Lat., violet colored). Abdomen: male, 26 mm.; female, 25 mm. Hind wing: male, 20 mm.; female, 21 mm.

Male: Violet. Thorax with black mid-stripe on top, shoulder stripe, and narrow lines on the side sutures. Abdomen violet, with the following black: interrupted ring on outer end of segments 2, 3 and 4, outer rings on 5 and 6; all of 7 excepting a basal ring; last two segments blue. Legs pale with dark lines.

Female: Brown or dull violet. Abdomen brown above, bounded on either side with an interrupted black stripe; pale blue or greenish below the black.

Habits similar to *A. apicalis*; spends more time on the wing. June on.

5. *Enallagma aspersum* Hagen (*aspersus*, Lat., spotted). Abdomen: male, 25 mm.; female, 24 mm. Hind wing: both 18 mm.

Male: Blue. Vertex black. Connected blue spots behind the eyes. Thorax with mid-stripe on top and shoulder stripes black. Abdomen blue; black as follows: basal spot on segment 1, outer spot on 2, outer two-thirds of 3, all of 4 to 6 (except narrow interrupted basal rings), basal half of 7 and 10.

Female: Lighter than male. Top of segments 1 to 10 with a longitudinal band, reduced to a narrow stripe on the greater part of 7 and 8, and interrupted basal rings on 3 to 6, black.

Habits similar to the preceding species. June on.

6. *Enallagma civile* Hagen (*civilis*, Lat., of citizens or civil). Abdomen: male, 25 mm.; female, 27 mm. Hind wing: male, 18 mm.; female, 20 mm.

Male: Blue. Large connected blue spots behind the eyes. Thorax with mid-stripe on top and shoulder stripes, black. The abdomen is blue; black as follows: basal spot on segment 1, outer spot on 2, outer third or fourth of 3 to 5, outer two-thirds of 6, all of 7 except an interrupted basal ring, and the top of 10.

Female: Blue of the male is replaced by a lighter blue, or yellowish green.

Habits: The habits of the *Enallagma* will be given under *Enallagma signatum*. June on.

7. *Enallagma signatum* Hagen (*enallatte*, Gr., to exchange or differ from; *signatus*, Lat., marked). Abdomen: male, 28 mm.; female, 27 mm. Hind wing: male, 17 mm.; female, 18 mm.

Male: Orange. Connected orange spots on the back of the head. Thorax with several bronze-black or dark green stripes; the shoulder stripe sometimes has a lilac or greenish stripe lying just below it. The top of the abdomen is black; all of segment 9 and the sides of 10, orange or pale yellow. Legs pale yellow.

Female: Similar. Usually more bluish than yellow. The sides of segment 9 are yellow, barely coming together at the outer end of the segment; 10 is entirely yellow. Legs darker than the male.

Habits: Common; graceful, active. Frequents sluggish or still water. Females rest in the weeds on the bank when not pairing or ovipositing. Males sun themselves on the lily pads some distance out from the bank. The teneral are dull blue. June on.

8. *Ischnura verticalis* Say (*ischnos*, Gr., lean; *ouri*, Gr., tail; *vertex*, Lat., highest point). Abdomen: male, 20 mm.; black female, 21 mm.; orange female, 22 mm. Hind wing: male, 13 mm.; black female, 14 mm.; orange female, 15 mm.

Male: Green. A short blue line connecting the eyes. Thorax striped with black. The top of the abdomen is black; segments 8 and 9 bright blue with a black stripe on either side. Apical spot on the front wings is black, on the hind wings brown.

Black female: Similar to male except that segments 8, 9 and 10 are black. The older specimens may be chalky white. The black female is more common than the orange female in autumn.

Orange female: Orange and bronze-black. The top of segments 4 to 10 are bronze-black. The sides of the abdomen and thorax are greenish; likely to be chalky white. In the spring the chalky-white females are more numerous than either the bright orange or black females.

Habits: Very weak fliers; blown about by the wind. They choose sheltered resting places. Common from June on.

9. *Lestes unguiculatus* Hagen (*lestes*, Gr., a plunderer; *unguiculus*, Lat., a finger nail). Abdomen: male, 28 mm.; female, 27 mm. Hind wing: male, 19 mm.; female, 21 mm.

Male: Blackish brown. A collar, shoulder sutures, face, under parts of the head, under parts of the thorax, yellow. Top of the abdomen is metallic green or brown; narrow interrupted basal rings on segments W to 7, passing into yellow on the sides of 1 to 7. The mature specimens of both sexes are more or less chalky white. The apical spot is brown, whitish at either end. Legs black and pale.

Female: Similar. Shoulder stripes wider. The rear of the head has a yellow band from eye to eye, obscure in older individuals.

Habits: Found about water, resting on dry weeds on the bank, not on the aquatic plants. Not common. July on.

ORDER ODONATA.

SUBORDER ANISOPTERA.

Family.	Subfamily.	Genus.	Species.
1. <i>Æschnidæ</i>	<i>Æschinæ</i>	<i>Æschna</i>	<i>pentacantha</i> .
2. <i>Æschnidæ</i>	<i>Æschinæ</i>	<i>Æschna</i>	<i>verticalis</i> .
3. <i>Æschnidæ</i>	<i>Æschinæ</i>	<i>Anax</i>	<i>junius</i> .
4. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Celethemis</i>	<i>elisa</i> .
5. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Celethemis</i>	<i>eponina</i> .
6. <i>Æschnidæ</i>	<i>Gomphinæ</i>	<i>Dromogomphus</i> ..	<i>spoliatus</i> .
7. <i>Libellulidæ</i>	<i>Cordulinæ</i>	<i>Epicordula</i>	<i>princeps</i> .
8. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Libellula</i>	<i>auripennis</i> .
9. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Libellula</i>	<i>basalis</i> .
10. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Libellula</i>	<i>cyanea</i> .
11. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Libellula</i>	<i>pulchella</i> .
12. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Libellula</i>	<i>vibrans</i> .
13. <i>Libellulidæ</i>	<i>Cordulinæ</i>	<i>Macromia</i>	<i>tæniolata</i> .
14. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Mesothemis</i>	<i>simplicollis</i> .
15. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Pachydiplax</i>	<i>longipennis</i> .
16. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Pantala</i>	<i>hymenæa</i> .
17. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Pantala</i>	<i>flavescens</i> .
18. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Perithemis</i>	<i>domitia</i> .
19. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Plathemis</i>	<i>lydia</i> .
20. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Sympetrum</i>	<i>albifrons</i> .
21. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Sympetrum</i>	<i>corruptum</i> .
22. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Sympetrum</i>	<i>semicinctum</i> .
23. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Sympetrum</i>	<i>vicinum</i> .
24. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Tramea</i>	<i>lacerata</i> .
25. <i>Libellulidæ</i>	<i>Libellulinæ</i>	<i>Tramea</i>	<i>onusta</i> .

